# Reinforcement Learning Assignment 1 - Checkpoint 1

## Problem Statement:
The aim is for the agent to reach the final state in minimum number of steps with maximum reward points.

***Q1***. Describe the deterministic and stochastic environments, which were defined (set of actions/states/rewards, main objective, etc).

## Objective:
The agent aims to reach the Reinforcement learning class in minimum number of steps, while collecting coffee as the positive reward 1 and completing the assignment as positive reward 2. The agent should avoid bunking classes as they lead to negative rewards and leave agent in a confused state.(render)

## States:
There are 16 states in the environment and position (0,0) is the initial stage and position (3,3) is the goal state.

## Actions:
The agent can move one step at a time and take 4 actions in the grid, left, right, up and down.

## Rewards:
There are 3 positive and 2 negative rewards in the environment.
**Positive rewards** are - position (1,3) with reward +0.3, position (3,0) with reward +0.6 and position (3,3) with reward +1.0

**Negative rewards** are- position (0,2) and position (2,0) with negative reward of -0.5 for each position.

## Environment:
While running the agent, the choice can be made to make the environment deterministic or stochastic. If the parameter ‘D’ is passed then the environment is Deterministic, else if ’S’ is passed then the environment is Stochastic in nature.

**Deterministic:** In the deterministic environment, the agent moves one step in any one of the four above mentioned actions with a probability of 1.

**Stochastic:** In the deterministic environment, the agent moves one step in any one of the four above mentioned actions with a probability of 7/10. The agents stays in the same state with a probability of 3/10.

***Q3***. How did you define the stochastic environment?
For the environment to be stochastic, we took a random variable from 0 to 9. If the random variable is between 0 and 6 then we move forward one step in the input action, else if the input is between 7 to 9, then the agent doesn't move to any state from the current state.

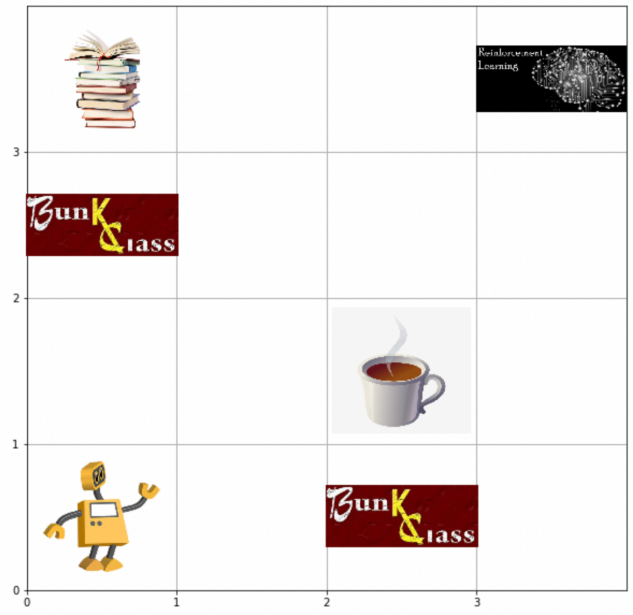
***Q4***. What is the difference between the deterministic and stochastic environments
In a deterministic environment, the states are fully observable and agent does not bother about uncertainty, but a stochastic environment is random in nature and cannot be determined completely by an agent. Either the actions can be random or rewards can be random or the environment could be dynamically changing.
In our project, we have chosen to introduce randomness to our actions in the stochastic environment.

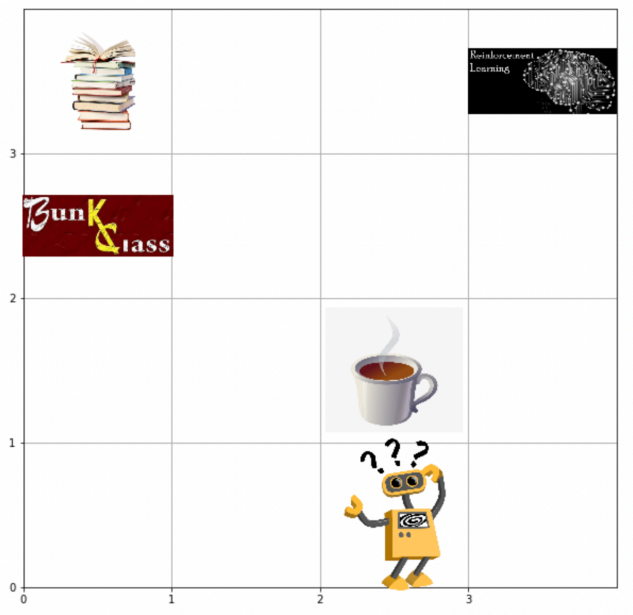
***Q5***. Write a brief review explaining how you ensure the safety of your environments.
A. Safety in AI is an important aspect to be taken into consideration. A safe AI agent doesn't encounter system failures, damage itself or cause harm to the environment. Robots must be able to safely learn and adapt online to solve their assigned tasks effectively and with high performance. We should ensure that this automatic adaption happens safely. Ie. If the agent takes an exploratory action that current policy should be able to recover.

Steps to ensure safety of environment:
- Explicitly model and learn about uncertainties in the robots dynamics and its environments.
- Develop algorithms for safe exploring and safe policy update.
- Secure the code and prevent it from being hacked and tampered.
- Encryption of data if agent is communicating with other agents or systems.
- Comprehend all possible threats and enable good design and implementation changes to secure the application.

Q2. Provide visualizations of your environments.

## Visualization:
- Figure 1 depicts the starting stage of the agent.
- Figure 2 depicts the agent encountering the 1st negative reward of bunking class.
- Figure 3 depicts the agent encountering the 1st positive reward of drinking coffee.
- Figure 4 depicts the agent encountering the 2nd negative reward of bunking class.
- Figure 5 depicts the agent encountering the 2nd positive reward of studying.
- Figure 6 depicts the agent in its goal state of reaching reinforcement learning class.


Reinforcement Learning
BunK Class
BunK Class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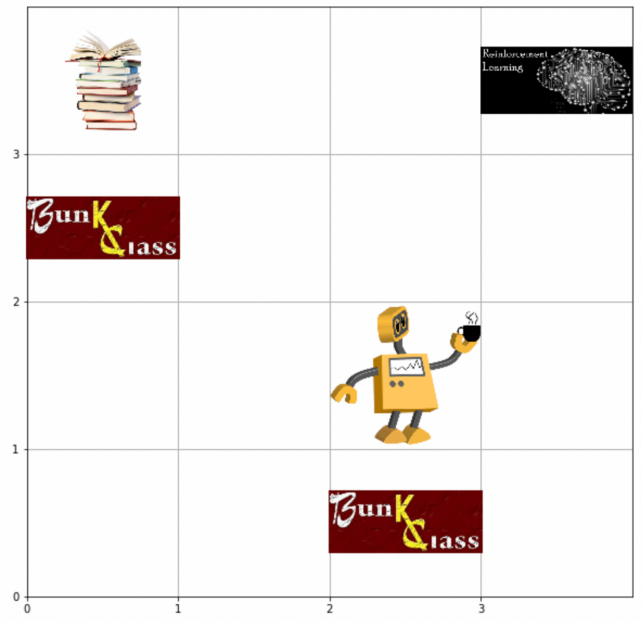
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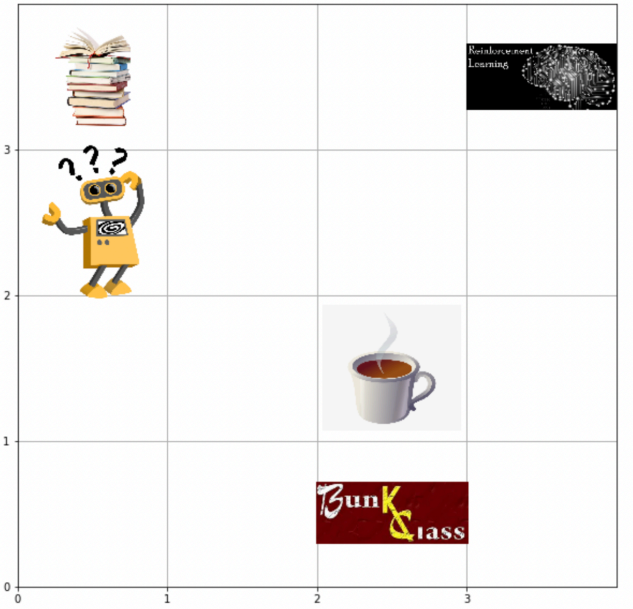
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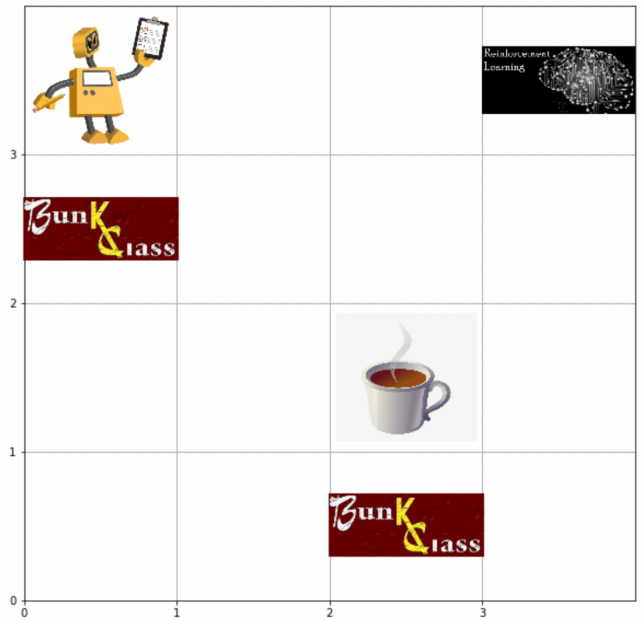
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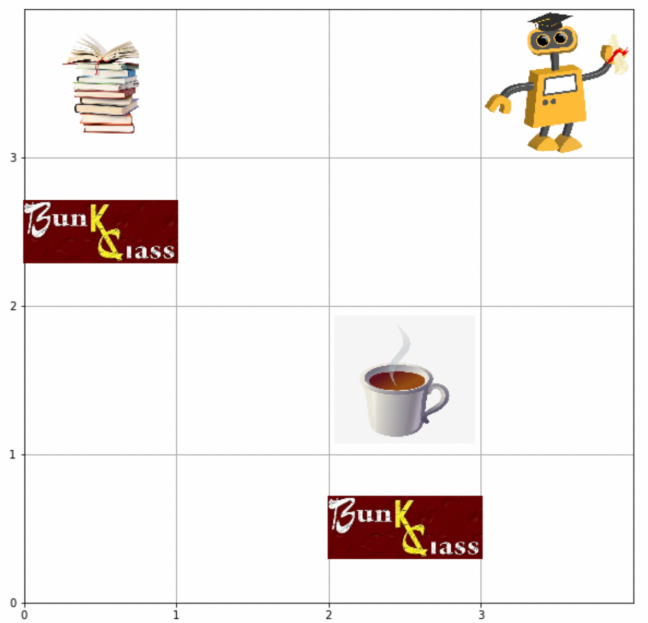
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